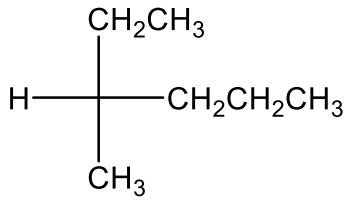
Exercise 11: - Stereochemistry

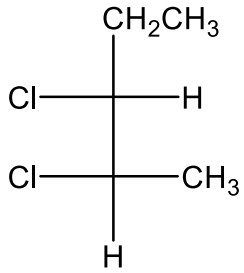
1. Name the following compounds by the IUPAC system. The name must indicate the stereochemistry of the compound.

   a.



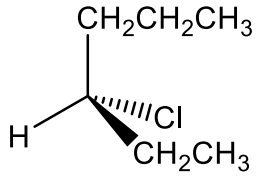
   (R)-3-methylhexane

   b.



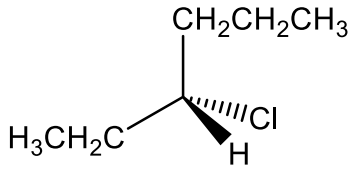
   (2R,3R)-2,3-dichloropentane

   c.



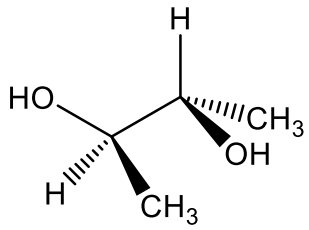
   (S)-3-chlorohexane

   d.



   (S)-3-chlorohexane

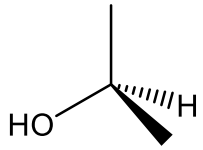
e.

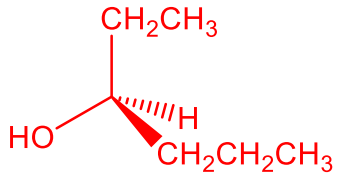


meso-2,3-butanediol

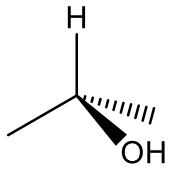
2. Complete the following partial structures of (S)-3-hexanol:

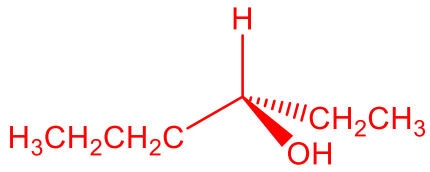
a.



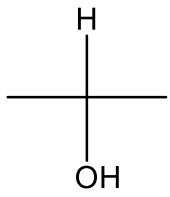


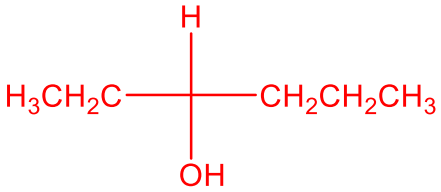
b.





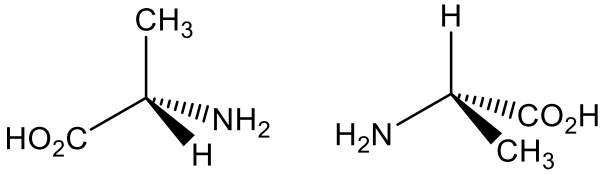
c.





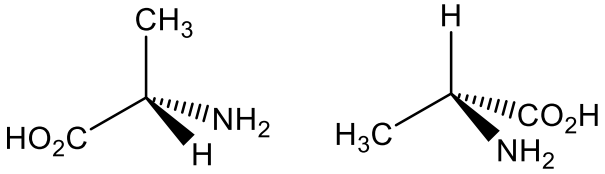
3. Consider the following pairs of structures. Identify the relationship between them as representing enantiomers, diastereomers, or two molecules of the same compound.

a.



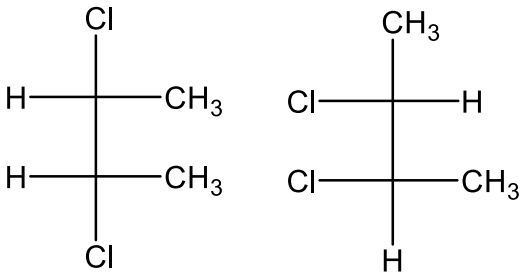
identical

b.



enantiomers

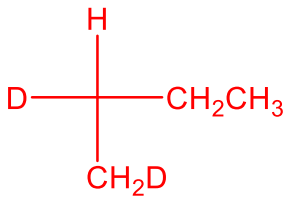
c.

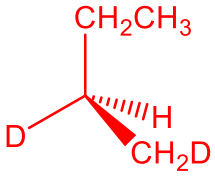


diastereomers

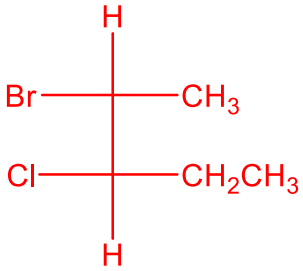
4. Draw

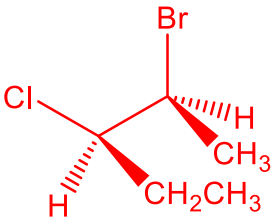
a. (*R*)-1,2-dideuteriobutane



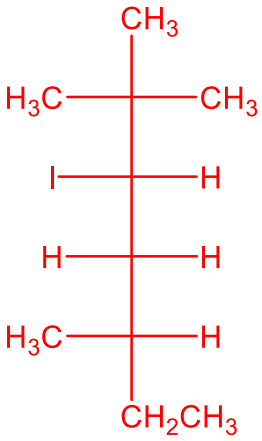


b. (*2S,3R*)-2-bromo-3-chloropentane

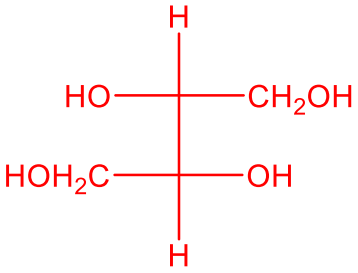




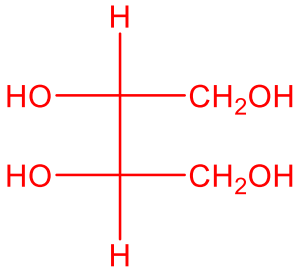
c. (*3S,5S*)-3-iodo-2,2,5-trimethylheptane



5. (*R*)-$HOCH_2CHOHCH{=}CH_2$ reacts with cold, alkaline $KMnO_4$ to give two products having the same formula, $HOCH_2CHOHCHOHCH_2OH$. One product is optically active and the other is optically inactive. Give the absolute configuration and *R/S* specification of the two products.

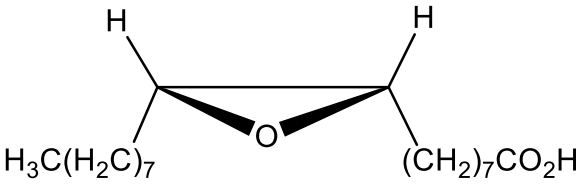


(2S,3S)

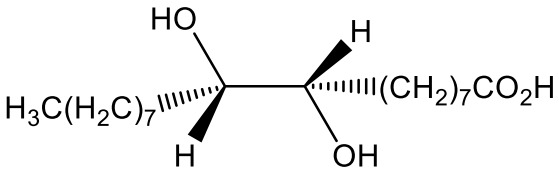


méso

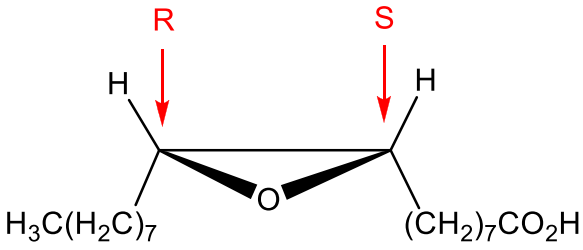
6. Microbial oxidation of oleic acid, $CH_3(CH_2)_7CH{=}CH(CH_2)_7CO_2H$, forms chiral 9,10-epoxystearic acid:

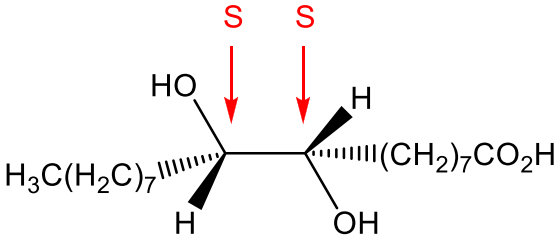


This then reacts with water, again under the influence of the microbe, to yield chiral 9,10-dihydroxystearic acid:

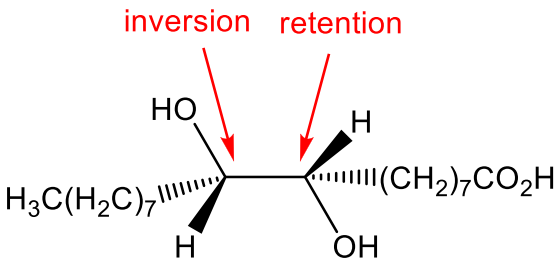


a. Assign the configuration (*R*/*S*) of all stereogenic centres.

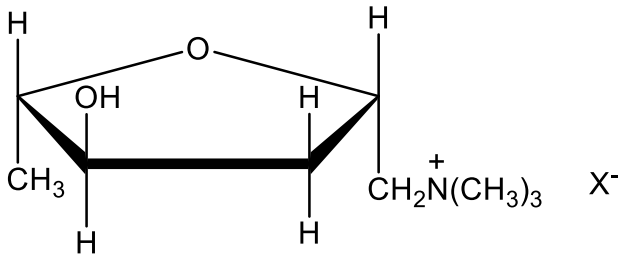




b. Indicate whether retention or inversion of configuration took place at each centre.



7. It is February, 1929. In a lonely cottage in Devonshire, George Harrison, a middle-aged amateur mycologist, has died shortly after eating a mushroom stew he prepared from warty caps (*Amanita rubescens*) collected in nearby Five-Acre Wood. Cause of death: poisoning by *muscarine*, and alkaloid found in the fly agaric (*Amanita muscaria*).

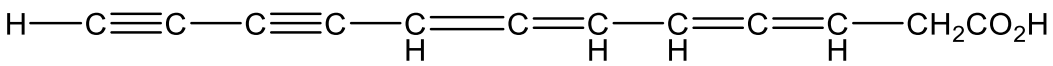


muscarine

You are Sir James Lubbock, Home Office Analyst, and you have been asked to help solve a knotty problem crucial to the investigation: whether (a) a deadly *Amanita muscaria* found its way accidentally into the mess of closely similar, but harmless, *Amanita rubescens*, or (b) a lethal dose of synthetic muscarine (filched from a London laboratory) was deliberately added to the stew pot - perhaps by the lover of the beautiful Mrs. Harrison. You have available a solution of muscarine that you isolated from left-over stew, a well-equipped (for 1929) laboratory and ten minutes. Tell what you can do that might give a definite answer to the question: was there a fly agaric in Mr. Harrison's soup or did a second cook, willfully and with malice aforethought, spoil the broth?

See if the sample is optically active. If yes, it was an accident; if no, synthetic muscarine was probably used and murder was committed! Remember – this is 1929!

8. Allenes are compounds with adjacent carbon-carbon double bonds. Many allenes are chiral even though they do not contain stereogenic centres. Mycomycin:



is a naturally occurring antibiotic isolated from the bacterium *Nocardia acidophilus*. It has $[\alpha]_D$ = -130°. Why is mycomycin chiral?